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ABSTRACT

Several intermediate performance objectives and corresponding criterion measures are presented for each of ten terminal objectives for a two-semester course (3 hours daily). This 540-hour intermediate course includes advanced troubleshooting techniques on outboard marine engines, inboard-outboard marine engines, inboard marine engines, boat rigging, boat trailer wiring and rigging, and refinishing and repair. The coursework includes basic theory and practical experience on actual engines and boats. Titles of the terminal performance objectives sections are Orientation, Engines, Electrical System, Ignition, Carburetion, Cooling, Service Fundamentals, Parts Inventory, Shop Management, and S.I.E. Program. (This manual and 54 others were developed for various secondary level vocational courses using the System Approach for Education (SAFE) guidelines.) (HD)

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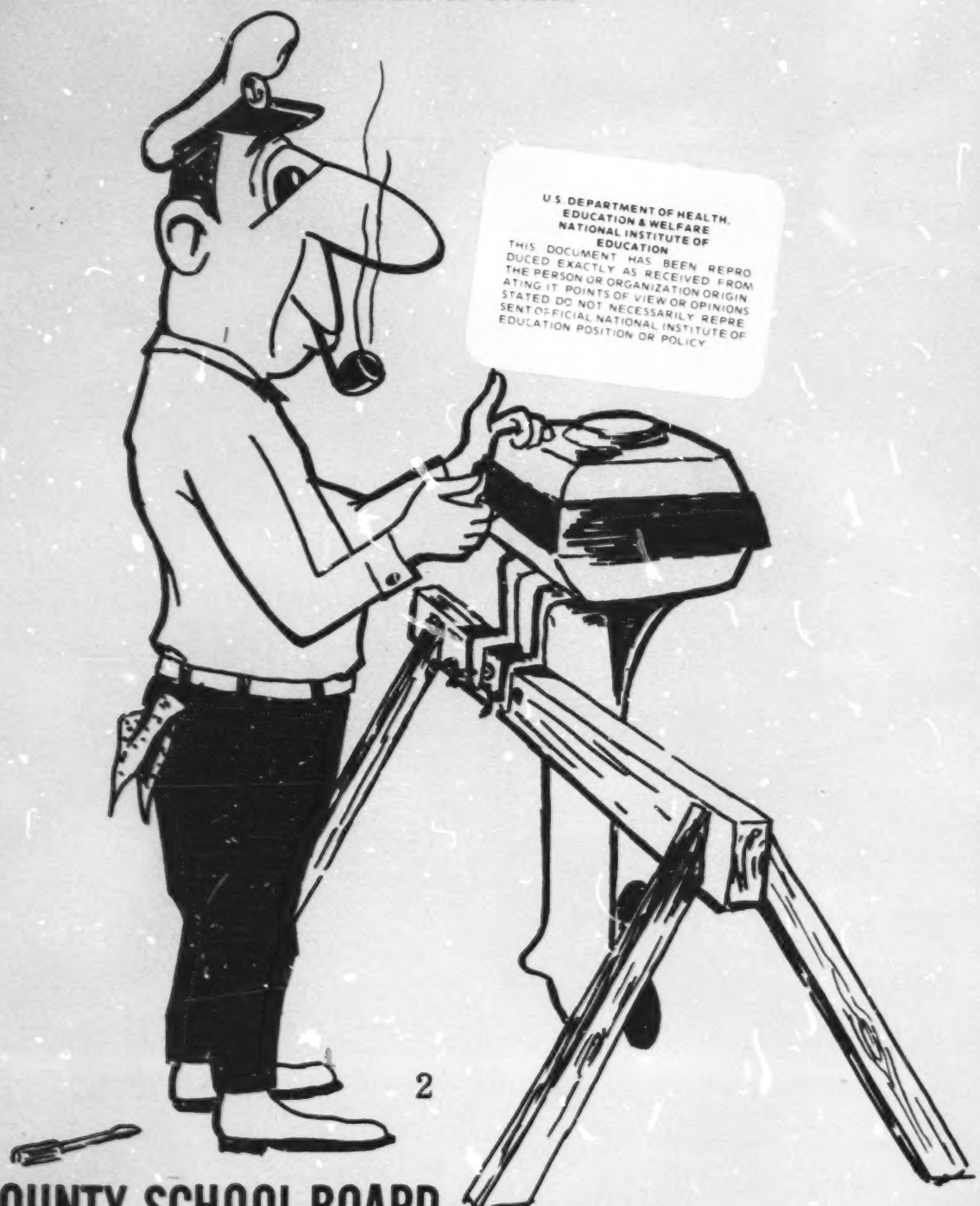
PERFORMANCE OBJECTIVES

MARINE ENGINE MECHANICS

INTERMEDIATE COURSE



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Duval County School Board
July, 1972

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MARINE ENGINE MECHANICS - INTERMEDIATE

Accreditation No. 9365

Length of Course: 2 Semesters

Time Block: 3 Hours Daily

Course Description

This 540 hour course includes advanced trouble shooting techniques on Outboard Marine Engines, Inboard-Outboard Marine Engines, Inboard Marine Engines, Boat Rigging, Boat Trailer Wiring and Rigging and Refinishing and Repair techniques for boats. The coursework includes basic theory and practical experience on actual engines and boats.

9365 - MARINE ENGINE MECHANICS - INTERMEDIATE

Syllabus of Terminal Performance Objectives

7.0 Orientation

8.0 Engines

9.0 Electrical System

10.0 Ignition

11.0 Carburetion

12.0 Cooling

13.0 Service Fundamentals

14.0 Parts Inventory

15.0 Shop Management

16.0 S.I.E. Program

MARINE ENGINE MECHANICS

PRACTICAL DEMONSTRATION RATING SCALE

ITEMS TO BE RATED	PERCENT VALUE ASSIGNED
1. Planning	15%
a. Operation order	
b. Selection of tools and materials	
c. Use of trade knowledge	
2. Product	
a. Accuracy (free of mistakes)	40%
b. Precision (adherence to limits)	
c. Finish (as required)	
3. Work Habits	
a. Cleanliness	30%
b. Order	
c. Care of tools (inventory)	
d. Safety	
e. Economy of materials	
4. Moral-Attitude	15%
a. Cooperation	
b. Iniative	
c. Dependability	

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS- INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 7.0 ORIENTATION

Upon completion of the orientation unit of instruction 90% of the students will answer 75% of the attached criterion test questions correctly.

No.	Intermediate Performance Objectives	No.	Criterion Measures
7.0		7.0	Circle one answer 1. Unsafe attire for wearing while working on engines/moving parts: a. Short sleeve shirts b. Shop coats c. Casual shoes d. Class ring e. Bracelet 2. Worn or broken tools should be: a. Discarded b. Continued in use c. Traded for replacements d. Reported on inventory and issued replacements. 3. Gas or oil fires are extinguished with a: a. Class A extinguisher b. " B " c. " C " d. " D " 4. When replacing a part, the part number should be used because: a. It expedites getting the part. b. Aids in substitution. c. It will be easier to find the list price. d. All the above.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 7.0

ORIENTATION

No.	Intermediate Performance Objectives	No.	Criterion Measures
7.0	Con't.	7.0	5. The cost of an item is found by: a. Checking the part number. b. Checking the reference number. c. Using part number with price index. d. Asking the boss. 6. All 2-cycle marine engines are water cooled. T. F. 7. A good mechanic when needing a torque valve refers to the: a. Specifications b. Parts manual c. Tool inventory d. Price index 8. When being interviewed by a prospective employer you should: a. Try to impress him by talking at length on any subject. b. Dress neatly and be direct. c. Ask the salary and benefits first, so as not to waste his time and yours. d. Ask him about his family.
7.1	Given a specific job title for study the student using sources available, will prepare a written or oral report in which each of the following will be discussed: 1. Starting salary 2. Advancement opportunities. 3. Fringe benefits. a. Insurance b. Retirement	7.1	Performance will be evaluated by criterion stated in objective.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 7.0

ORIENTATION

No.	Intermediate Performance Objectives	No.	Criterion Measures
7.2	By researching the "yellow pages" student will determine the approximate number — places of employment in his field, in the Jacksonville area.	7.2	Oral report "Which area of marine and boating field interests you most? Why?
7.3	The student will make an inventory of a box of tools given him, nomenclature, quantity and condition. 90% of the tools must be catalogued correctly.	7.3	Criteria contained in I.P.O.
7.4	Given a selected number of used engine components student will by the use of measuring tools determine disposition correctly i.e. reject, repair "use as is" by manufacturer's specifications. 80% must be diagnosed correctly.		
7.5	Given a customer's engine student will estimate repairs to put engine back into operating condition. He will determine by use of publications (repair manual, parts catalog, price index) all the necessary data and enter on the work sheet.	7.5	Criteria contained on the I.P.O.
7.6	Given problems involving the four fundamental operations in math the student will solve 70% correctly.	7.6	Test attached.

I.P.O. 7.5 CRITERION TEST (MATH REVIEW)

1. a) 29 + 36 =
   b) 35 + 109 =
   c) 408 + 399 =
   d) 365 + 346 =
   e) 977 + 264 =
   f) 1024 + 522 + 610 + 302 =
   g) 264 + 977 + 408 + 29 + 36 =
   h) 352 + 624 + 273 + 2066 =

2. a) 36 - 29 =
   b) 109 - 35 =
   c) 408 - 399 =
   d) 5000 - 123 =
   e) 977 - 264 =
   f) 2096 - 1111 =
   g) 408 - 29 =
   h) 1237 - 639 =

3. a) 25 x 25 =
   b) 205 x 205 =
   c) 369 x 909 =
   d) 1237 x 639 =
   e) 977 x 264 =
   f) 2096 x 1111 =
   g) 408 x 29 =
   h) 1007 x 1000 =

4. a) 388 ÷ 4 =
   b) 2323 ÷ 101 =
   c) 4653 ÷ 9 =
   d) 11,832 ÷ 29 =
   e) 42,025 ÷ 205 =
   f) 1,552 ÷ 388 =
   g) 1,007000 ÷ 1000 =
   h) 17,000 ÷ 68 =

5. a) .006 + .1.2 =
   b) 2.008 - 2.5 =
   c) 1.08 x 9 =
   e) .04 ÷ 005 =
   f) 11 + 1.1 + .11 =
   g) .23 + .23 + 2.3 =

MATH REVIEW CON'T.

5. d) 1.1 ÷ .1 =

h) .02 + 0.4 + 4.678 =

6. a) ½ + 2/3 =

b) ½ - 1/3 =

c) 3/4 + ½ =

d) 3/5 + 1/16 =

e) 7/8 - ¼ =

f) 3/4 ÷ ½ =

g) 1 1/7 x 3 ÷ 1/3 =

h) 2 x 2/1 x 3/4 - ½ =

7. a) A bench top is 20 inches wide and 78 inches long. What is the area in square feet?

b) A box is 15 inches deep, 30 inches long and 36 inches wide. What is the cubic foot volume?

c) A cylinder has a diameter of 6 inches and a length of 50 inches. What is the volume in cubic inches.

d) Find the area of a piece of wood measuring 6½ ft. long and 3 1/3 ft. wide.

e) A pipe has a diameter of 2 inches. If it were 4 inches approximately how much more water would flow through this pipe?

f) Find the area of a window 3' x 5'.

g) Find the area of a triangle 5' on the base and 5' high.

h) Find the area of a circle with a diameter of 2'.

8. a) Find the surface area of a cube that is 3 ft. tall.

b) Find the volume of a cylinder 4 ft. tall and 4 ft. in diameter.

c) Find the volume of a cube that is 3 ft. tall.

d) Find the volume of a room that is 20 ft. long, 30 ft. wide and 8 ft. high.

e) Find the cubic inch displacement of a single cylinder engine with a 3 inch bore and 2½ inch stroke.

f) Find the cu. inch displacement of a 4 cylinder engine with a bore of 2.80 inch and stroke of 2.5 inch.

g) Find the cubic inch displacement of an 8 cylinder engine that is said to be "square". The bore is 3.0 inches.

h) If the bore of a cylinder is 3.0 inches and the piston diameter is 2.995, what is the side clearance.

9. a) 8:1 as 16:?

b) 20:7 as ? :28

c) 39:3 = x:1

d) Using a 32:1 fuel-oil ratio, how many ounces of oil would be required for one gallon of gasoline?

e) For an engine requiring a 40:1 fuel-oil ratio how much oil would you mix with 1 $\frac{1}{4}$ gallons of fuel?

f) The 6 gallon cruise tank for an outboard using a 24:1 fuel-oil mixture should have _____ounces of oil mixed with a full tank.

g) Write five thousandths of an inch in it's decimal equivalent.

h) How would you write down the dimension of a crankshaft that measures one and four hundred fifty-five thousandths of an inch.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 8.0

ENGINES

The learner will demonstrate his knowledge and ability to disassemble and assemble an outboard engine. Procedures will be 100% complete as defined in the manufacter's manual — In addition — 85% of the learners will upon completion of this unit of instruction, answer correctly 75% of the sample criterion tests questions.

No.	Intermediate Performance Objectives	No.	Criterion Measures
8.0		8.0	1. Die cast aluminum is used in the engine construction because: a. of it's light weight b. divisions in the crankcase are small and fit closely around the moving parts. c. Divisions in the crankcase are used to keep each cylinder separate. d. all of the above 2. Main bearing oil seals must be in good condition to: a. keep engine tight b. prevent oil leaks c. seal the crankcase d. all of the above 3. The water pump _____ should be checked whenever there is no evidence of water circulation. 4. If the engine will run but propeller will not turn the probable cause may be: a. drive pinion broken b. prop shear pin broken c. RPM too high
8.1	Given the task of rough sketching a two cycle engine, with each of the events identified, the student will complete with 70% accuracy.	8.1	Criteria contained in I.P.O.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 9.0

ELECTRICAL SYSTEM

Upon completion of the electrical unit of instruction 90% of the students will answer 75% of the attached criterion test questions correctly — in addition — will demonstrate ability to follow instructions 100% as specified in the manufacturer's service manual.

No.	Intermediate Performance Objectives	No.	Criterion Measures
9.0		9.0	1. The storage battery converts chemical energy into _____ energy. 2. The battery plates are prevented from touching each other by: a. separators b. connectors c. terminals 3. The battery is filled with a solution of sulphuric acid and: a. light weight oil b. muriatic acid c. inert gas 4. Electrical generators are used to convert _____ energy into electrical energy. 5. The D.C. generator has a lower "coming in" speed than the alternator. T. F. 6. The voltage of alternating current can be stepped up or down by the use of: a. rectifiers b. regulators c. transformers 7. The starting safety switch prevents the motor from being _____ at advanced throttle.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE OBJECTIVE NO. 8.0

ENGINES

No.	Intermediate Performance Objectives	No.	Criterion Measures
8.2	Given an outboard powerhead, the student will disassemble completely and using the proper manual will measure all dimensions and clearances. These will be used to determine proper specifications, marginal tolerances, and wear, if any, with 100% accuracy.	8.2	Criteria contained in I.P.O.
8.3	Following assignment contained in I.P.O. the student will determine cause of wear, if any, and order replacement parts noting date, and corrective action required on work order with 100% accuracy.	8.3	Criteria contained in I.P.O.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 9.0

ELECTRICAL SYSTEM

Upon completion of the electrical unit of instruction 90% of the students will answer 75% of the attached criterion test questions correctly — in addition — will demonstrate ability to follow instructions 100% as specified in the manufacturer's service manual.

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9.0		9.0	1. The storage battery converts chemical energy into _____ energy. 2. The battery plates are prevented from touching each other by: a. separators b. connectors c. terminals 3. The battery is filled with a solution of sulphuric acid and: a. light weight oil b. muriatic acid c. inert gas 4. Electrical generators are used to convert _____ energy into electrical energy. 5. The D.C. generator has a lower "coming in" speed than the alternator. T. F. 6. The voltage of alternating current can be stepped up or down by the use of: a. rectifiers b. regulators c. transformers 7. The starting safety switch prevents the motor from being _____ at advanced throttle.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 9.0 ELECTRICAL SYSTEM

No.	Intermediate Performance Objectives	No.	Criterion Measures
9.0 Con't.		9.0 Con't.	8. The voltage regulator prevents: a. overcharging b. short circuits c. battery leakage
9.1	Given a print-out of a storage battery, student will label parts as specified — 80% of students will attain 70% accuracy.	9.1	Criteria contained in I.P.O.
9.2	Given an alternator or generator with simple discrepancies created by instructor, the learner will diagnose and advise the corrective action with 90% accuracy.	9.2	Criteria contained in I.P.O.
9.3	The student after instruction on the starting system, will accurately answer 75% of the criterion test questions. — In addition — The student will remove, disassemble, reassemble and re-install a manual starter utilizing the proper service manual with 100% accuracy.	9.3	1. On all motors equipped with fly wheel alternator the rectifier will be damaged if battery leads are disconnected while engine is running or leads are reversed. T. F. 2. The starter lock-out used on Mercury motors: a. Prevents electric starter from engaging while motor is running. b. Prevents manual starter engagement while motor is running. c. Prevents manual starter from being pulled at high speed throttle settings.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE OBJECTIVE NO. 9.0

ELECTRICAL SYSTEM

No.	Intermediate Performance Objectives	No.	Criterion Measures
9.0 Con't.		9.3	3. To replace the manual starter cord on an Evinrude 40 HP: a. It is not necessary to disassemble the unit. b. The unit must be disassembled. c. The spring must be unwound. 4. When removing spring assembly: a. Pull tang and let spring unwind. b. Oil lightly before removing. c. Protect hands with gloves or cloth, remove spring and allow to unwind slowly.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE OBJECTIVE NO. 10.0 IGNITION

After completion of instruction in the ignition unit, the learner will demonstrate his knowledge and ability to disassemble and assemble, time and adjust the ignition system of an outboard engine with 100% accuracy as defined in manufacturer's manual. In addition — 85% of the learners will upon completion of this unit of instruction, answer correctly 75% of the sample criterion test question.

No.	Intermediate Performance Objectives	No.	Criterion Measures
10.0		10.0	1. Match the below ignition systems with the engine it is used on: (1) "Magnapower ( ) (2) "Thunderbolt" ( ) (1) Johnson (2) Chrysler (3) Mercury 2. When experiencing trouble in the ignition system the first item that you should check is: a. The condenser b. The breaker points c. The spark plug d. The stator plate 3. Dirty or loose connections, or deteriorated insulation may cause a _____drop through the primary circuit. 4. The condenser should always be replaced when replacing the breaker contact points: T. F. 5. Glazed deposits on the spark plug points are easily removed: T. F. 6. Breaker contact points which appear dull, gray, and slightly pitted, indicate a ( ) normal, or ( ) abnormal, ignition condition.

ACCREDITATION NUMBER 9365

COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE OBJECTIVE NO. 10.0 IGNITION

No.	Intermediate Performance Objectives	No.	Criterion Measures
10.0 Con't.		10.0 Con't.	7. A "flat spot" or 4 cycling" condition that can not be corrected by adjusting the full mixture (carburetor) is usually caused by: a. Incorrect throttle to ignition synchronization. b. Incorrect ignition breaker point gap. c. Either of the above. 8. Magneto edge gap can change (and spark intensity thereby reduced) due to the following: a. Flywheel drive key sheared. b. Excessive wear on breaker cam. c. Loose fly wheel retaining nut. d. All the above.
10.1	Given the problem of drawing a sketch of a simple battery ignition system, the student will label the 13 main components. 85% of the students will attain 70% accuracy.	10.1	Criteria contained in I.P.O.
10.2	Given a print out of a cut away coil, 85% of the students will label the main components with accuracy.	10.2	Criteria contained in I.P.O.
10.3	The learner will define the main difference between the battery ignition system and the magneto ignition system. by 85% answering the criterion test questions with 75% accuracy.	10.3	Match the ignition systems with the statements: (a) Magneto (b) Battery 1. ( ) uses stored chemical energy of a battery. 2. ( ) constant direct current. 3. ( ) pulsating alternating current.

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COURSE TITLE: MARINE ENGINE MECHANICS- INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 10.0 IGNITION

No.	Intermediate Performance Objectives	No.	Criterion Measures
10.3 Con't.		10.3 Con't.	4. ( ) uses permanent magneto. 5. ( ) used by most outboard motors of one or two cylinders. 6. ( ) the coil is the same type used in automotive systems. 7. ( ) the secondary circuit ground polarity cannot be reversed. 8. ( ) usually used by motors of 3 or more cylinders.
10.4	The student will identify the advantages of the capacitance discharge ignition as compared to the conventional battery ignition by 85% of answering 75% of the criterion questions.	10.4	1. In the capacitance discharge ignition system, the capacitor: a. has been moved from the distributor and relocated. b. is located in the secondary. c. is much larger. 2. The hotter spark generated is due primarily to the: a. larger capacitor. b. different type breaker point. c. rapid build up and discharge of the capacitor. 3. The capacitor is discharged into the: a. ignition coil primary. b. ignition coil secondary. c. breaker point assembly. 4. The speed with which the magnetic field builds up and collapses is: a. 60 to 80 milli-seconds.

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 10.0 IGNITION

No.	Intermediate Performance Objectives	No.	Criterion Measures
10.4 Con't.		10.4	b. 40 to 50 milli-seconds. c. 1 to 2 milli-seconds.
10.5	Given the problem of repairing/replacing, breaker points, the learner will time the ignition system and diagnose it's condition by the physical aspects of the contacts. 85% of the students will attain 100% accuracy.	10.5	Criteria contained in the I.P.O.
10.6	Given the problem of sketching a spark plug and labeling the main parts. 95% of the students will attain 70% accuracy — in addition —	10.6	1. All spark plugs are basically the same but they do differ in the: a. thread size d. spark gap. b. reach e. all the above c. heat range 2. Listed in the individual motor's condensed Service Data table: a. brand and price of plug. b. type, heat range and electrode gap. c. instructions for cleaning plug and setting gap. 3. The heat range of a plug is determined by: a. length of the center electrode b. plug reach c. length of the ceramic insulator exposed to the combustion chamber. d. the electrode gap.

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 10.0 IGNITION

No.	Intermediate Performance Objectives	No.	Criterion Measures
10.0 Con't.		10.6	4. After "sand blasting" a plug and before setting the gap: a. The points should be properly dressed with a point file: b. Coat with a film of light oil. c. Tap the electrodes lightly to insure no abrasive is left on plug. 5. The plug gap should be set with: a. feeler gage b. micrometer c. wire gage d. calipers 6. Deposits on a normal firing plug would be: a. black c. gray metallic b. light tan d. damp 7. A misfiring plug would most likely have deposits which are: a. damp, oily, residue b. dry, gray colored c. glassy and bead like 8. Over-torquing a plug could possibly alter the gap. T. F.
10.7	Using an approved tester, student shall run tests on a condenser for leakage and shortage with 100% accuracy.	10.7	Criterion contained in I.P.O.

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 10.0 IGNITION

No.	Intermediate Performance Objectives	No.	Criterion Measures
10.0 Con't. 10.7	— In addition — he will be required to test the ignition wiring for leakage and analyze its condition as to "weather cracking", oil deteriation, chafing etc.		
10.8	Student will draw up at least 4 safety rules to be observed when working on the ignition system. 85% will attain 75% accuracy.	10.7	Criterion contained in I.P.O.

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 11.0 CARBURETION

After completion of instruction in the Carburetion unit, the learner will demonstrate his knowledge and ability to trouble shoot problems, disassemble, clean, assemble and adjust a carburetor with 100% accuracy as defined in the manual.

In addition: 85% of the learner's will answer correctly 75% of the criterion questions correctly.

No.	Intermediate Performance Objectives	No.	Criterion Measures
1.0		11.0	1. The purpose of the carburetor is a. Meter the fuel to provide the proper fuel-air ratio. b. Atomize the fuel and mix it with the air flow in the carburetor throat. 2. Carburetor operation is based on: a. Newton's Law b. The Venturi Principle c. Carlton's theory 3. The choke valve controls: a. The air flow b. The fuel flow c. The fuel-air flow 4. The throttle valve controls: a. The air flow b. The fuel flow c. The fuel-air flow 5. The reed valve is essentially a check valve which: a. Traps the fuel-air charge in the crankcase. b. Permits the fuel-air mixture to move in only one direction through the engine. c. Does both A and C. 6. In the venturi the speed up of air

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 11.0 CARBURETION

No.	Intermediate Performance Objectives	No.	Criterion Measures
11.0		11.0	flow causes a resultant: a. Drop in pressure b. Increase in pressure c. Does not affect pressure 7. Generally the initial settings for adjusting needles is: a. Too lean b. Not necessary c. Too rich 8. The bulk of carburetor service consists of: a. Overhaul b. Replacing parts and assemblies c. Cleaning, inspection and adjustment.
11.1	Given the problem of sketching a simple fuel system and labeling the main components and explaining the function of each, 85% of the students will perform with 75% accuracy.		
11.2	Given, the task of checking a reed valve for condition, a student will disassemble, repair if needed, assemble and adjust an assembly according to the manufacturer's manual with 100% accuracy. In addition- 85% of the students will answer 75% of the criterion tests questions correctly.	11.2	1. Significant changes in altitude requires a change in the size of the high speed fixed jet. Would the replacement be: a. Larger at 6,000' than S.L. b. Smaller at 6,000' than S.L. 3. The same used at 1000'. 2. A warped or bent reed should be:

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 11.0 CARBURETION

No.	Intermediate Performance Objectives	No.	Criterion Measures
11.2	(cont 'd)	11.2	a. Straightened if possible b. Renewed. c. Disregarded if only one petal is damaged. 3. The reed plate is located between the _____ manifold and crankcase. 4. Gum from the fuel residue can seriously affect the operation of the operation of the main fuel jet. T._F.__
11.3	The student will analyze instructor created discrepancies on a fuel system and carburetor and make proper repair/adjustment to return to normal operating condition, according to the manufacturer's specifications with 100% accuracy. In addition- 85% of the students will answer correctly 75% of the criterion questions.	11.3	1. A broken reed would be most noticeable : a. At low speed b. At high speed c. At half throttle 2. The diaphragm fuel pump can be operated : a. Mechanically b. Electrically c. By vacuum d. Any of above 3. No acceleration, idles well, but when put to full power dies down: a. Mixture too lean b. choke partially closed c. Float level too low d. Any of the above

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 11.0 CARBURETION

No.	Intermediate Performance Objectives	No.	Criterion Measures
11.3	(cont'd)	11.3	4. To perform at varying speeds the carburetor incorporates: a. Separate idle system b. A large fixed jet c. A split throttle valve 5. The pressurized tank fuel system uses: a. A single hose and vented tank. b. Two hoses c. A shut-off valve. 6. Engine run at high speed only by using hand primer: a. Float level too low. b. Fuel pump not supplying enough fuel. c. Fuel filter obstructed d. All the above 7. Low speed miss or motor will not idle smoothly and slowly enough: a. Spark plug wires reversed. b. Water in fuel c. Reed valve standing open or stuck shut d. All the above. 8. With carburetor and ignition timing not synchronized, the following troubles would be

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 11.0 CARBURETION

No.	Intermediate Performance Objectives	No.	Criterion Measures
11.3	(Cont'd)	11.3	a. Coughs, spits, slows b. Wont start, kicks back, backfires into lower unit. c. High speed miss d. Any or all of the abov

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 12.0 COOLING

No.	Intermediate Performance Objectives	No.	Criterion Measures
12.0 Con't.		12.0	6. The cooling system must be designed to maintain: a. a hot temperature b. coolest temperature c. coolant within a certain range 7. The pump is driven by the: a. a rotor b. eccentric c. drive shaft or propeller shaft 8. How high can the heat of combustion reach: a. 2000°F c. 6000°F b. 4000°F d. 1000°F
12.1	Given a print-out outline of an outboard engine, 90% of the students will trace the water flow with 75% accuracy.	12.1	Criteria contained in the I.P.O.
12.2	Given the problem of sketching an impeller type water pump and labeling the main components 90% of the students will complete with 75% accuracy.	12.2	Criteria contained in the I.P.O.

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TECHNICAL OBJECTIVE
OBJECTIVE NO. 12.0 COOLING

Upon completion of the cooling systems unit of instruction 90% of the students will answer 75% of the criterion questions correctly.

No.	Intermediate Performance Objectives	No.	Criterion Measures
12.0		12.0	1. The outboard engine uses the following type of cooling system: a. air-cooled b. liquid-cooled c. air-cooled and liquid cooled. d. any of the above. 2. To control the coolant temperature the system uses a: a. thermostat b. by-pass jacket c. water pump impeller 3. Name three types of water pumps used on outboards: a. _____ b. _____ c. _____ 4. The water pump is located in: a. the power head b. lower unit c. water outlet 5. On most outboard motors, the flow is held at a relatively constant level, regardless of engine speed by: a. the thermostat b. the pump design c. the pressure control valve

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 13.0 SERVICE FUNDAMENTALS

After completion of this unit of instruction the student will demonstrate the proper procedures of assembling, test running and adjusting a new/overhauled outboard in accordance with the specific engineering service manual. 90% of the students will attain 75% accuracy.

No.	Intermediate Performance Objectives	No.	Criterion Measures
13.1	Given the task of performing periodic maintenance on an engine, the learner will demonstrate his proficiency and knowledge in this phase of maintenance by 90% of the students accurately performing and filling in the maintenance form provided.	13.1	Criteria contained in I.P.O.
13.2	Given the task of performing a mid-season (or 50 hours) check on an engine, 90% of the students will attain 90% accuracy using the manufacturer's recommended guide.	13.2	Criteria contained in I.P.O.
13.3	Given an outboard engine to conduct off-season storage service on, 90% of the students will perform accurately, utilizing the manufacturer's prescribed list or the Marine Service Manual of Recommended Practices. In addition- 85% of the learners will answer 75% of the criterion test questions accurately.	13.3	1. If the motor was last run in salt water, the first step for storage would be: a. To oil and wipe down thoroughly. b. To drain fuel system. c. To run it in fresh water. d. To drain and refill gear case. 2. When injecting oil to the powerhead, the motor should be running and oil squirted: a. Into the carburetor air intake. b. Into the lower drive unit. c. Into the exhaust system. d. Into the water pump cavity. 3. Circle any statement that applies when storing an engine for an extended period: a. Store in upright position. b. Disconnect spark plug leads.

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 13.0 SERVICE FUNDAMENTALS

No.	Intermediate Performance Objectives	No.	Criterion Measures
13.3	(Cont'd.)	13.3	(Cont'd.) c. Drain and refill gear case d. Completely drain and clean fuel tank e. Wipe motor down externally with cloth soaked in light oil. f. Check carburetor adjustment g. Properly gap spark plugs 4. The motor should be stored in a dry, well-ventilated room. T.____ F.____
13.4	Given an outboard engine to perform pre-season preparation on, 90% of the students will correctly perform, as per manufacturer's instructions or the Marine Service Manual of Recommended practices.	13.4	Criteria contained in I.P.O.
13.5	Given the task of conducting maintenance on an engine that has been submerged, 90% of the learners will be required to perform an accurate and complete inspection, service, repair and return the motor to operating condition. In addition- 85% of them will answer correctly 75% of the criterian test questions correctly.	13.5	1. The more difficult and exacting maintenance required to return a submerged engine to operating condition would be: a. Salt water submersion b. Fresh water submersion 2. Chrome or nickel plating are a form of galvanic action. T.____ F.____ 3. Aluminum parts are protected from corrosion by a process called: a. annealing b. heat treating c. oxidation

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 13.0

SERVICE FUNDAMENTALS

No.	Intermediate Performance Objectives	No.	Criterion Measures
13.5	(Cont'd.)	13.5	(Cont'd.) 4. Most manufacturers recommend the use of an anti-fouling paint on the lower unit of the motor. T.____ F.____

ACCREDITATION NUMBER 9363

COURSE TITLE: MARINE ENGINE MECHANICS (INTERMEDIATE)

TERMINAL OBJECTIVE
OBJECTIVE NO. 14.0 PARTS INVENTORY

The student will with 80% proficiency make up an initial parts order for a 6 man service shop and set up a sample inventory control Kardex System.

No.	Intermediate Performance Objectives	No.	Criterion Measures
14.1	With 80% proficiency write up a parts order for functional parts for a 6 man service shop.	14.1	Write up a functional parts order.
14.2	Draw a sample inventory control card and set up sample Kardex system.	14.2	Draw an inventory control card and set up sample Kardex for inventory control.

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COURSE TITLE: MARINE ENGINE MECHANICS (INTERMEDIATE)

TERMINAL OBJECTIVE
OBJECTIVE NO. 15.0

SHOP MANAGEMENT

The student will with 80% proficiency draw up an organization chart for a 6 man service department and make up a years operating budget.

No.	Intermediate Performance Objectives	No.	Criterion Measures
15.1	With 80% proficiency draw an organization chart for a marine engine service department.	15.1	Draw an organization chart for a marine engine service department.
15.2	Prepare with 80% proficiency a yearly operating budget for a 6 man service shop.	15.2	Prepare operating budget for a 6 man service shop.

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COURSE TITLE: MARINE ENGINE MECHANICS - INTERMEDIATE

TERMINAL OBJECTIVE
OBJECTIVE NO. 16.0

S.I.E. PROGRAM

Upon demonstrating 75% proficiency in the first and second year of training, displaying good work habits and altitudes the student shall be selected for participation in the School Industry Program for Marine Mechanics.

No.	Intermediate Performance Objectives	No.	Criterion Measures
16.0		16.0	To enter the S.I.E. program the student will be recommended by his instructor upon the completion of 75% of the Basic and Intermediate course objectives.
16.1	The learner will achieve 80% as stated in the training agreement for the School Industry Education Program.	16.1	Employer and S.I.E. Coordinator evaluation per training agreement.